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RESEARCH OF GASSINESS OF THE FOUNDRY SAMPLES WITH A VIEW TO GYPS MIXTURES

SLEDOVÁNÍ PLYNATOSTI SLÉVÁRENSKÝCH VZORKŮ SE ZAMĚŘENÍM NA SÁDROVÉ MATERIÁLY

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ABSTRACT: Article deals with causes of gassiness foundry mixtures and further largely himself following gassiness these mixtures depending on time and preparation designs for this measuring. There is a newly reconstructed and well-tried arrangement to our department KSP TU in Liberec. This apparatus was used for these experiments. Article further shows abstractedly rated informative funds postneuritic gas from most frequent chemical response in practices proceed. In next parts is demonstration processed graph and measured values for choice loose complex core mixtures and graph and measured values for the gypsum as material for foundry cores in dust form and in hardened form.

KEY WORDS: Gassiness, Core mixture, Sand mixture.

1 INTRODUCTION

Production high-quality castings in forms from sand mixtures to a certain extent nearly bears and with quality foundry hand forms and core room. Gassiness is unfortunate feature forming and core mixture therefore is following gassiness in the long term devoted grande attention.

On department engineering technology TU in Liberec by 80's years last century engineered quite a number of gauging arrangement for indirect method measuring gassiness forming and core mixture. It always been endeavour to quantity slack gas or their pressure was registered to depending on time.

This arrangement was step by step honed and due to modern constructional elements with possibility computer application was to our workplace engineered and well-tried arrangement that the traces time dependence slack gas at warming sample examinational mixtures. Purpose hereof benefit is acquaint wide foundry hand public with record gassiness choice core and forming mixtures.

2 GASSINESS FORMING AND CORE MIXTURES

Gassiness is ability forming (core) materials liberate at warming - up fumes odd. These are undesirable action detailing partial behaviour these dispersive materials at high temperatures, shortly after circumfusion foundry hand forms and hence would had value gassiness embody what lowest funds. Gassiness mean in cm3 on 1g mixtures, foreground on cm3 mixtures. Quantity solvent gas in sand form is in virtue of kind binder and his share in mixtures, slant mixtures to wettability, granulity opening material (permeability core room) and content different ingredients mark out for call hardener response or to goal - directed technological needs on by herself nuclei. Damaging effect

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these fluent performances depends on their quantity, on vehemence their development and on their constitution.

Except quantity slack gas be of consequence kinetics their development but also instant of time vacation in the process of solidification metal. From components sand mixture embodies considerable gassiness water and next liquid solvent, some way minerals, binder, organic additives and next matters.

In table 1 are mentioned dissociative temperature some materials.

Tab. 1 - Dissociative temperature some materials [1]

Gassy share in mixtures [matters.%]	Critical temperature analysis [°C]
Watter	100
Clay bonding agent	200 to 400
Calcite (CaCO3)	860 to 910
Sulphite solution bonding agent	220 to 260
IF resin	280 to 320
FF resin	650 to 750

In table 2 are mentioned funds percentage lease vacation gas at different suits production from of the total gas at foundry.

Tab. 2 - Funds percentage lease vacation gas at different suits production from of the total gas at foundry [1]

	Percentage share from gross content slack gas [%]		
Processes production gas	Raw forms	Wizened forms	Shell casting forms
Evaporation waters included in mixtures	50 to 60	8 to 12	3 to 5
Blow - out organic materials	2 to 3	5 to 8	2 to 10
Distillation organic materials	30 to 40	45 to 65	80 to 90
Vacation H_2O from minerals	0,5 to 8	15 to 25	0,5 to 2
Analysis mineral admixture	1 to 5	1 to 5	1 to 2
Expansion air	to 0,5	to 1	to 0,5
Dissociation gas	6 to 9	8 to 12	10 to 15

Gassiness like feature forming and core mixture traces almost from beginnings development and exercise assorted mixture. Among cardinal cause rise gas in forms lines processes, e.g.: Vaporization waters et al. solvents, combustion (burning, oxidation) organic materials, pyrolysis organic materials (distillation), pyrolysis minerals, dissociation gas and tension air.

On the basis above - mentioned chemical suits were to be effected theoretic informative calculations that the establish entitlements quantity postneuritic capacity gas for individual response see table 3. In reality it is possible to that at warming mixtures will slip and more different response that the make for resulting quantity slack gas.

Tab. 3 - Funds calculations quantity slack gas at chemical responseś

Type response	Quantity slack gas from 1 gramme components
$C\,(s) + O_2\,(g) \longleftrightarrow CO_2\,(g)$	from 1g C(s) →1,866 dm^3 CO_2 (g)
$2C\,(s) + O_2\,(g) \longleftrightarrow 2CO\,(g)$	from 1g C(s) →1,866 dm^3 CO (g)
$C\,(s) + CO_2\,(g) \longleftrightarrow 2CO\,(g)$	from 1g C(s) →3,73 dm^3 CO (g)
$C\,(s) + H_2O\,(g) \longleftrightarrow CO\,(g) + H_2\,(g)$	from 1g C(s) →3,73 dm^3 gasses mixture CO(g) a H_2(g).
$C\,(s) + 2H_2O\,(g) \longleftrightarrow CO_2\,(g) + 2H_2\,(g)$	from 1g C(s) →5,598 dm^3 gasses mixture CO_2(g) a H_2(g).
$Fe\,(s) + CO_2\,(g) \longleftrightarrow FeO\,(s) + CO\,(g)$	from 1g Fe(s) →0,4 dm^3 CO(g)
$3Fe\,(s) + 4H_2O\,(g) \longleftrightarrow Fe_3O_4\,(s) + 4H_2(g)$	from 1g Fe(s) →0,534 dm^3 H_2(g)
$FeO\,(s) + C\,(s) \longleftrightarrow Fe\,(s) + CO\,(g)$	from 1g C(s) →1,866 dm^3 CO(g)
$CH_4\,(g) \longleftrightarrow C\,(s) + 2H_2\,(g)$	from 1dm^3 CH_4(g)→2 dm^3 H_2(g)
$CaCO_3\,(s) \longleftrightarrow CaO\,(s) + CO_2\,(g)$	from 1g $CaCO_3$ (s) →0,224 dm^3 CO_2(g)

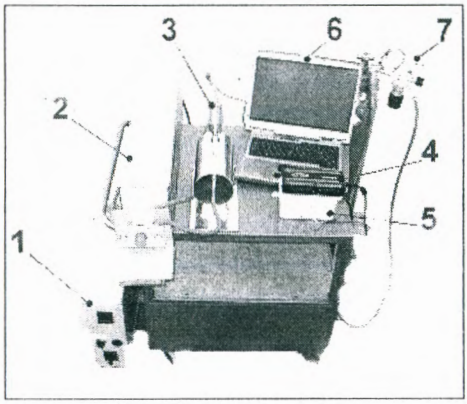
Remark: Calculations were to be effected at constant atmospheric pressure.

3 DESCRIPTION METHODISTS MEASURING GASSINESS DESIGNS CORE ROOM

To assessment time behaviour gassiness and obtaining concrete values maximum sizes gassiness we're used laboratory arrangement KSM TUL.

Measuring equipment gassiness start from methodists measuring gassiness on apparatus PGD (firm +GF+), it means as though in hatch seat power control smeltery warms radiant warm specimen tracked mixtures (forming or core). Slack fumes postneuritic at combustion are guidee to the special cylindrical bowl powered compressive sense organ. Compressive sense organ takes pressures solvent gas. Their quantity is registered busbar data and attempt life to the PC. By are extract time dependencies capacity slack gas.

Measure installation handles next progress. Sample mixtures about materiality 1,00 ± 0,01 g warms in open pump from molybdenous metal plate which makes it possible to his superfast warming-up from under first moments after interpolation sample to the space sealed - off quartz pipe that the is placed in seat power control resistive multitube oven. Number designs were minimally 5 for every type metering.



1 -regulator smeltery; 2 – Mars oven; 3 – compressive sense organ; 4 – data bus line; 5 – energizer for busbar; 6 – PC; 7- pressure tank with gas (N_2), which be instrumental towards Cleaning atmospheres smeltery before metering.

Fig. 1 - View of complex modernized measuring equipment gassiness forming and core mixtures

To metering gassiness designs from already hardened core room get in compact sample – stick about proportions c. 5x5x35 mm about materiality 1±0,01 g ready excision from concrete sample core. Number designs return to be minimally 8 for every type metering. Seats taking of samples are elective with reference to type, proportions and size core room. Achieved records are processed in programme Microsoft Excel in an advance created programmes for quicker processing.

4 EXPERIMENTAL FOLLOWING GASSINESS CORE MIXTURES

To following gassiness were to be used loose mixtures from firm Huttenes–Albertus and Sand team before their setting and gypsum mixtures in the dust and hardened form.

Sample tracked mixtures were nag at on chemical balance LECO EB 25. Embankment 1g mixture was loose on ceramic pump from molybdenous metal plate that belong gauging arrangement. Pump with embankment subsequently telescopes to the smeltery measuring equipment. Atmosphere smeltery is in advance heated on temperature, at which want to trace evolution gas. It's beginning take measurements gassiness mixtures. Gassiness designs were tracked at temperature 1000 °C in oven. Were used exhibits loose complex mixture 15731, 15947, 20020, 15970, 15994 (Huttenes–Albertus) and TPR 210 F (Sand team). (Fig.3) On Fig. 2 we used gypsum mixtures Kittfort in dust and hardened form. Starwation wages values on this graph shows gassiness loose gypsum mixture Kittfort depending on time at temperature 1000 °C in hardened form. Higher values shows gassiness loose gypsum mixture Kittfort depending on time at temperature 1000 °C in dust form.

On the basis experimental experience showed, that it is sufficient opt for maximum time evolution gas 120 [s]. To this spell were to be tracked all tracked dependencies gassiness mixture.

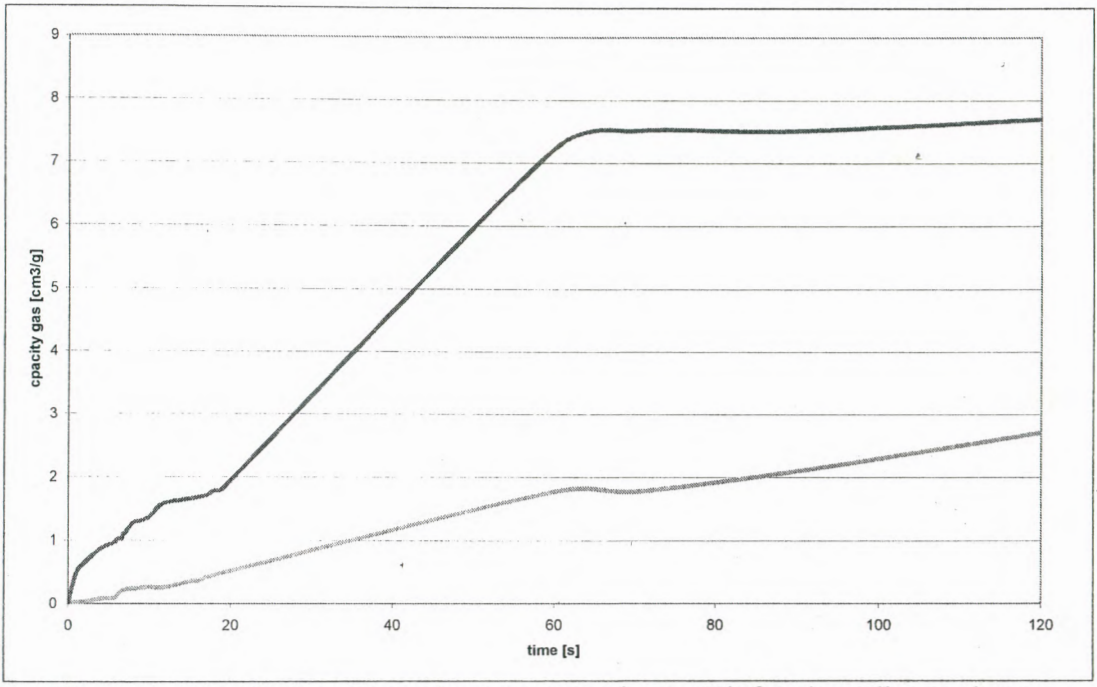


Fig. 2 - Average funds gassiness loose gypsum mixtures Kittfort depending on time at temperature 1000 °C,

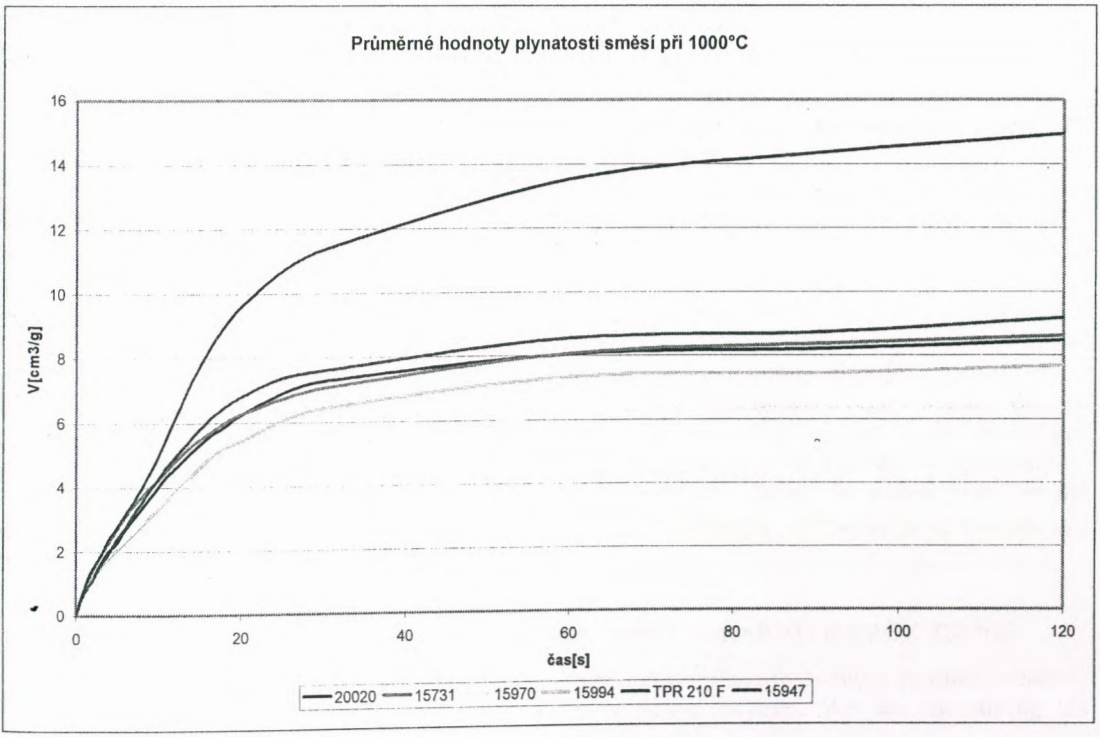


Fig. 3 - Average funds gassiness loose complex mixture depending on time at temperature 1000 °C,

5 CONCLUSIONS

Arrangement for following gassiness forming and core mixtures an engineered on KSP-TU in Liberec with usage constructional elements sufficient in a way makes it possible to measuring time dependence gassiness. From test data choice loose mixture at temperature 1000 °C it stands to reason, that the lowest gassiness embodies mixture 15970 whose gassiness in 120 [s] after warming does 6,34 cm3.g-1. Further relatively low gassiness embodies and mixture 15994 that the is 7,68 cm3.g-1. On the contrary highest gassiness embodies mixture 15 947 whose gassiness at temperature 1000°C is 14,9 cm3.g-1. Big differences values gassiness those mixtures were to be ascertained also near single plumbed faction which acknowledges our presumption as to influence superficiality elements opening material in connection with quantity bonding agent. Value gassiness mixtures 15974 about sizes elements faction 0,1 mm embody appreciate 19,1 cm3.g-1. Value gassiness those mixtures near faction about sizes elements 0,15 mm is 13,8 cm3.g-1and near faction about sizes elements 0,3 mm is already only 10,8 cm3.g-1. In this way it is possible weigh against appreciate gassiness mixtures in different time moments after warming.

6 REFERENCES

[1] KALOUSEK, J., KALOUSKOVA, G., HOLUBEC, Z. physical chemistry metallurgical suits. [mimeographed]. FS, VŠST Liberec 1990.

[2] RUSIN, et. Al.: Dispersive investment material. [mimeographed]. Prague 1985.

[3] JELINEK, P.: Connective system foundry hand forming mixture. 1. vyd. Ostrava 2004.

[4] SEIDL, M.: Arrangement for metering gassiness. [groundwork for solving doctoral work]. KSP FS, THAT in Liberec 2006.

[5] MACHUTA, J.: Appreciation gassiness choice foundry hand mixtures [diploma work]. KSP FS, THAT in Liberec 2007.

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